

WE CLAIM:

1. An electric door lock that is interchangeable between fail safe and fail secure modes, comprising:

a housing for receiving the internal components of the door lock;

5 a latch bolt mounted within said housing and being movable between partially extended from and retracted into said housing;

a doorknob mounted to said housing and rotatable to retract said latch bolt; and

10 a solenoid assembly mounted within said housing that can be interchangeably arranged to cause said lock to operate a fail secure mode wherein said doorknob is prevented from retracting said latch bolt when said solenoid is not energized, or a fail safe mode wherein 15 said doorknob is allowed to retract said latch bolt when said solenoid is not energized, said solenoid nested in place within said housing in both modes.

2. The door lock of claim 1, further comprising a cradle mounted to said housing, said solenoid being nested in place within said housing by being mounted within said cradle, said solenoid being held in place by

5 surfaces of said cradle and surfaces of said housing.

3. The door lock of claim 2, wherein said solenoid is nested within said housing without being affixed to said housing.

4. The door lock of claim 1, wherein said solenoid assembly comprises a solenoid body, plunger and rod/tip assembly, said plunger mounted within and fully drawn into said solenoid body when said solenoid assembly is energized, said rod/tip assembly capable of being mounted to either end of said plunger to interchange said solenoid assembly between fail safe and fail secure modes.

5. The door lock of claim 4, wherein said plunger and rod/tip assemblies operate on said lock internal components to allow operation in the fail safe or fail secure modes.

6. The door lock of claim 4, further comprising a spring to provide a bias to urge said plunger to extend from said solenoid body when said solenoid assembly is not energized.

7. The door lock of claim 6, wherein said spring is arranged between solenoid body and said rod and tip assembly, said spring being compressed between said solenoid body and rod/tip assembly when said solenoid assembly is energized to draw in said plunger.

8. The door lock of claim 1, further comprising a hub mechanism with said doorknob mounted thereto and a coupling member, said coupling member movable between a first coupling position to allow said hub mechanism to rotate when said doorknob is rotated or a second coupling position wherein said hub mechanism is not allowed to rotate when said doorknob is rotated, said hub mechanism

retracting said latch bolt when said hub mechanism is rotated.

9. The door lock of claim 8, wherein said solenoid assembly is in the fail safe mode and causes said coupling member to be in said first position when said solenoid assembly is not energized.

10. The door lock of claim 10, wherein said solenoid assembly is in the fail secure mode and causes said coupling member to be in said second position when said solenoid assembly is not energized.

11. The door lock of claim 8, further comprising a locking lever operably arranged between said solenoid assembly and said coupling mechanism, said solenoid assembly causing the movement of said locking lever 5 between first and second locking lever positions, said movement of said locking lever causing said coupling mechanism to move between said first and second coupling positions.

12. The door lock of claim 11, further comprising a rocker arm operably arranged between said locking lever and said coupling member, the movement of said locking lever between said first and second locking lever 5 positions causing said rocker arm to be moved between first and second rocker arm position, thereby causing said coupling member to move between said first and second coupling positions.

13. The door lock of claim 1, further comprising a plurality of electrical switches to indicate the position of said lock internal components.

14. The door lock of claim 1, further comprising a hub mechanism with said doorknob mounted thereto and said latch bolt comprises a latch retractor, said hub mechanism also comprising a latch bolt finger to engage 5 said latch bolt wherein said latch bolt finger floats on top of said latch retractor.

15. The door lock of claim 1, wherein said latch bolt comprises a one piece retractor to prevent damage to said lock internal components when said doorknob is forcibly turned.

16. The door lock of claim 1, wherein said latch bolt comprises a retractor that melts at an elevated temperature so that said latch bolt cannot thereafter be retracted.

17. An electric door lock that is interchangeable between fail safe and fail secure modes, comprising:

 a housing for receiving the internal components of the door lock;

5 a latch bolt mounted within said housing and being movable from partially extending from and retracted into said housing;

 a doorknob mounted to said housing and rotatable to retract said latch bolt into; and

10 a solenoid assembly mounted within said housing and comprising a solenoid body, plunger and rod/tip assembly, said plunger movably mounted within and drawn into said

15 solenoid body when said solenoid assembly is energized, said rod/tip assembly capable of being mounted to either end of said plunger to interchange said solenoid assembly to cause said lock to operate in a fail safe or fail secure modes.

18. The door lock of claim 17, wherein said plunger and rod/tip assembly are arranged in the fail secure mode wherein said doorknob is prevented from retracting said latch bolt when said solenoid body is not energized.

19. The door lock of claim 17, wherein said plunger and rod/tip assembly are arranged in the fail safe mode wherein said doorknob is allowed to retract said latch bolt when said solenoid is not energized.

20. The door lock of claim 17, further comprising a locking lever, said rod/tip assembly operable on one end of said locking lever, the other end of said locking lever operable on said doorknob.

21. The door lock of claim 20, wherein the extension of said rod/tip assembly from said solenoid body moves said locking lever to a first lever position that causes said lock to operate in either the fail safe or fail secure 5 mode, the retraction of said rod/tip assembly moving said locking lever to a second lever position that causes said lock to operate the other of either the fail safe or fail secure mode.

22. The door lock of claim 17, wherein said solenoid assembly is nested in place within said housing without being affixed to said housing.

23. The door lock of claim 17, further comprising a cradle located within said housing, said solenoid assembly being nested in place within said housing by being nested within said cradle, said solenoid assembly 5 being held in place by surfaces of said cradle and surfaces of said housing and said cover plate.
24. The door lock of claim 17, further comprising a spring arranged between solenoid body and said rod/tip assembly, said spring being compressed between said solenoid body and rod/tip assembly when said solenoid 5 assembly is energized to draw in said plunger, said spring having a spring rate that substantially matches the power curve of said solenoid.
25. An electric door lock that is interchangeable between fail safe and fail secure modes, comprising:
- a housing for receiving the internal components of the door lock;
 - 5 a latch bolt mounted within said housing and being movable from partially extending from and retracted into said housing;
 - a doorknob mounted to said housing;
 - a solenoid assembly nested within said housing;
 - 10 a hub mechanism mounted within said housing with said doorknob mounted thereto and a coupling member, said coupling member mounted within said housing and movable between a first coupling position to allow said hub mechanism to rotate when said doorknob is rotated and a second coupling position wherein said hub mechanism is 15 not allowed to rotate when said doorknob is rotated, said

hub mechanism retracting said latch bolt when said hub mechanism is rotated; and

20 a locking lever mounted within said housing and operably arranged between said solenoid assembly and said coupling mechanism, said locking lever movable by said solenoid assembly between first and second locking lever positions which cause said coupling mechanism to move between said first and second coupling positions.

26. The door lock of claim 25, wherein said solenoid comprises a solenoid body, a plunger within said solenoid body and a rod/tip assembly mounted to said plunger, said plunger being drawn into said solenoid body when said 5 solenoid assembly is energized, said rod/tip assembly engaging said locking lever to move it between said first and second locking lever positions.

27. The door lock of claim 25, further comprising a cradle located within said housing, said solenoid assembly being nested in place within said housing by being mounted within said cradle, said solenoid assembly 5 being held in place by surfaces of said cradle and surfaces of said housing and said cover plate.

28. The door lock of claim 26, further comprising a conical spring arranged between solenoid body and said rod/tip assembly, said spring being compressed between said solenoid body and rod/tip assembly when said 5 solenoid assembly is energized to draw in said plunger.

29. A solenoid assembly, comprising:

a solenoid body having a longitudinal bore, a coil surrounding said longitudinal bore;

5 electrical conductors to apply an electrical signal
to said coil;

 a plunger movably arranged within said longitudinal
bore and drawn into said solenoid housing when said coil
is energized; and

10 a rod/tip assembly mounted to said plunger; and
 a solenoid spring mounted between said rod/tip
assembly and said solenoid body, said solenoid spring
compressed when said plunger is drawn into said solenoid
body, said solenoid spring urging said rod/tip assembly
to extend from said solenoid body when said coil is not
15 energized.

30. The solenoid assembly of claim 29, wherein said
solenoid spring has a spring rate and said solenoid
assembly has a power curve, said spring rate of said
solenoid spring substantially matching the power curve of
5 said solenoid assembly.

31. The solenoid assembly of claim 29, wherein said
plunger has first and second plunger ends, said rod/tip
assembly capable of being mounted to said first end of
said plunger and capable of being mounted to said second
5 end of said plunger.

31. The solenoid assembly of claim 29, wherein said
solenoid spring is a conical spring.